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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/160,965	09/25/98	SHUE	S TSMC97-542/9

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MM91/1003

EXAMINER

KIELIN, E

ART UNIT	PAPER NUMBER
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2813

DATE MAILED:

10/03/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/160,965

Applicant(s)
Shue et al.

Examiner
Erik Kielin

Group Art Unit
2813



☒ Responsive to communication(s) filed on Aug 14, 2000

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-12 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-12 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Request for Continued Examination

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/14/00 has been entered.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 5-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lin** (US 6,093,656).

Regarding claims 5 and 10, **Lin** discloses the silicon substrate 12, the damascene trenches 13, 14 in a dielectric layer, the barrier metal layer (column 3, lines 17-23); the copper layer 20 (or "conductor," claim 1); the reverse tone photoresist mask (column 3, lines 32-57; Fig. 3); etching

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the exposed copper portions down to the silicon using a wet etch (Fig. 4; column 4, lines 15-21); stripping the photoresist (column 4, lines 22-25); planarizing the copper by CMP (column 4, lines 27-29). See also columns 1-4 and all figures.

Lin does not teach the capping layer. Examiner gives Official Notice that it is well known to use capping layers over copper. Furthermore, Applicant has not shown in the disclosure how the use of a capping layer *after* planarization has anything to do with the main objective of the instant invention: planarization of copper damascene. Absent evidence to the contrary, the presence or absence of the capping layer would not affect the results of those steps occurring *before* the addition of such a layer.

Regarding claim 6, Lin does not indicate that the dielectric is silicon oxide, but it is known to use silicon oxide for the dielectric. Regarding claims 7-8, Lin uses a wet etch of HCl or HF rather than Applicant's HNO₃ or dry etch using Cl₂, but it is known to etch copper using either of Applicant's claimed processes. Regarding claim 9, in claim 1 of Lin, the layer 20 is limited to only "conductors" and therefore makes the use of any of Applicant's claimed conductors obvious. It has been held that selection of a known material based on its suitability for its intended use is *prima facie* obvious. See *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See also *In re LESHIN*, 125 USPQ 416 (CCPA 1960). The choice of silicon oxide for Lin's dielectric; Au, Al, with, Ti, or Ag for Lin's conductor; and substitution of HNO₃ for Lin's wet copper etch or, alternatively a Cl₂ dry copper etch are obvious as amounting obvious material choice, well within the purview of those of ordinary skill.

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Regarding claims 11-12, Lin makes clear the inherency or alternatively suggests Applicant's "critical dimensions" in Lin's discussion of the reverse tone photoresist mask. It's use is obvious as a matter of routine optimization. These claims are *prima facie* obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

3. Claims 1-2, and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin and in view of Datta et al. (US 5,567,300).

Lin is applied as above. Lin does not (1) specifically use the terminology, "dual damascene" or show a dual damascene structure in the figures. Lin does not teach (2) the seed layer or electroplating; or (3) reverse current electroplating.

Regarding (1), aside from it being known in the art that *dual* damascene (as opposed to *single* damascene) is also subject to dishing during metal planarization and for the same reasons (see for example, Fiordalice et al., US 5,578,523, column 1, line 59 to column 2, line 27), Lin's claim 1 indicates the damascene, dielectric trenches have "at least two levels of elevation." A third level of elevation would clearly yield a dual damascene trench structure. Therefore, Lin implicitly defines the invention for dual damascene.

Regarding (2) Examiner gives Official Notice that seed layers and electroplating to deposit copper or other metal layers are notoriously well known in the art, the gross details of which can be found in the ASM Handbook on Surface Engineering, Vol. 5. Such information will be

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provided upon Applicant's request. Furthermore, Lin teaches that the blanket deposition of copper "could be done in a number of different ways..." (column 3, lines 23-27). Consequently, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use any conventional copper deposition method for the reason given in Lin.

Regarding (3), **Datta et al.** and references cited therein teach the benefits of reverse current electroplating for the purpose of removing unwanted metal -- particularly copper -- regions for the purpose of planarizing (sections entitled "Planarization is desirable for two reasons" and "There are various planarization methods").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Lin in view of Datta for the reasons given in Datta.

Response to Arguments

4. Applicant's arguments with respect to claims 1-12 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

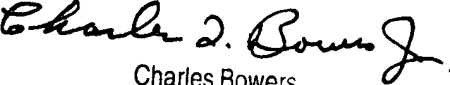
5. Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980. The examiner can normally be reached by telephone on Monday to Friday 8:00 AM until 5:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached on (703) 308-2417. The fax phone number for the group is (703) 308-7722.

EK

September 28, 2000


Charles Bowers
Supervisor Patent Examiner
Technology Center 2800